REMARKS

This amendment is responsive to the non-final Office Action mailed on August 23, 2005. Claims 1-15 and 42-45 were pending before the amendment, claim 6 has been cancelled, and claims 1, 7-9, 11-13, 42, 43, and 45 have been amended. In view of the foregoing amendments, as well as the following remarks, Applicants respectfully submit that this application is in complete condition for allowance and request reconsideration of the application in this regard.

Rejection of Claims Under 35 U.S.C. § 112

Claims 43 and 45 stand rejected as failing to comply with the written description requirement and for failing to particularly point out and claim the subject matter Applicants regard as the invention. In conjunction with this rejection, Page 2 of the Office Action refers to insulating material (40) shown in Applicants' Fig. 10B. However, insulating material (40) identified by the Examiner constitutes the gate dielectric; not the insulating material set forth in claims 43 and 45. At page 12, lines 19-20 of Applicants' specification, Applicants describe that portions of layer (44), which is also an insulating material, may fill any free space between the nanotubes (42) and may also fill each of the gaps (38). Nevertheless, Applicants have amended claim 43 and 45 for purposes of clarity. Consequently, Applicants request that the rejection be withdrawn.

Rejections of Claims Under 35 U.S.C. §§ 102, 103

Roesner Rejections

Claims 1, 5-8, 12-15 and 42-45 stand rejected under 35 U.S.C. § 102(e) as anticipated by Roesner et al. (U.S. Pub. No. 2003/0132461), hereinafter *Roesner*. Claims 2-4 and 9-11 stand rejected under 35 U.S.C. § 102(e) as anticipated by or, in the alternative, rejected under 35 U.S.C. § 103(a) as obvious over *Roesner*. Claims 1 and 42 are the only independent claims. The

Examiner contends that *Roesner* shows or teaches all the elements of the rejected claims. Applicants respectfully disagree for the reasons set forth below.

In contrast to claim 1, as amended, *Roesner* does not disclose or suggest "a spacer of a dielectric material flanking said vertical sidewall and spaced horizontally from said vertical sidewall of said gate electrode to define a vertical passage, a semiconducting nanotube positioned in said vertical passage, and a gate dielectric disposed on said sidewall between said semiconducting nanotube and said gate electrode." Instead, *Roesner* discloses a structural arrangement in which the nanotube (108) is positioned inside a small-diameter hole (106) defined in the gate electrode (104). *See* paragraph [0063]. *Roesner* discloses that the gate electrode (104) is formed from a metal. *See* paragraph [0061]. Hence, the hole (106) in *Roesner* is surrounded circumferentially by the metal of the gate electrode (104). The sidewalls of the gate electrode (104) are constituted by the unlabeled peripheral edges of the rectangular block labeled with reference numeral (104) in Figures 1A-C of *Roesner*. These sidewalls are exterior sidewalls that do not border the passage (106).

Applicants' passage is not located inside peripheral edges of the gate electrode such that the conductive material of the gate electrode surrounds or encircles the circumference of the passage, as disclosed in *Roesner*. Instead, Applicants' passage (34) is defined between the sidewall (31) of the gate electrode (28a) and the spacer (32), as set forth in Applicants' amended claim 1. Applicants' passage (34) is bounded on one side by the sidewall (31) of the gate electrode (28a), as set forth in Applicants' amended claim 1. Applicants' passage (34) is bounded on the other side by the dielectric material of the spacer (32), as set forth in Applicants' amended claim 1. Applicants unambiguously show the sidewall (31) of the gate electrode (28a) that flanks the passage in which the nanotube is located as an exterior sidewall of the body of conductive material constituting the gate electrode (28a). *See, e.g.,* Fig. 13B of Applicants' specification. The sidewall (31) of gate electrode (28a) does not border an interior surface because the passage (34) is not defined within the body of conductive material constituting gate electrode (28a).

In order for a reference to anticipate the invention in a claim, the reference must teach each and every element in the precise arrangement set forth in the claim. If the reference fails to teach even one of the claimed elements, the reference does not and cannot anticipate the claimed invention. *Roesner* fails to disclose the arrangement of the sidewall of the gate electrode, the spacer, and the passage, as set forth in Applicants' claim 1, as amended. For at least this reason, Applicants' independent claim 1 is patentable over *Roesner*. Consequently, Applicants respectfully request that this rejection be withdrawn.

Applicants' claim 1 is patentable for additional reasons. Specifically, the Examiner identifies the portion of the gate electrode (104) to the left of the nanotube (108) as a spacer that is also labeled with reference numeral (104). However, this identification is an impermissible construction by the Examiner of the disclosure in *Roesner* as the alleged spacer is actually constituted by a portion of the gate electrode (104). More specifically, the Examiner cannot properly construe the structure labeled with reference numeral (104) in *Roesner* to be both a gate electrode and a spacer and then use that improper construction to reject Applicants' claim 1. As set forth in Applicants' amended claim 1, Applicants' spacer is formed from a dielectric material. The Examiner identifies a gate dielectric (109) in *Roesner*. For similar reasons, the structure labeled with reference numeral (109) in *Roesner* cannot be construed by the Examiner as both a spacer and a gate dielectric. Even if the Examiner's construction of the gate electrode and spacer in *Roesner* were valid, which it is not, then the spacer labeled with reference numeral (104) would have to be formed from the same material as the gate electrode (104). Obviously, the material of the gate electrode (104) in *Roesner* cannot be a dielectric material as the device would be inoperative. For at least this additional reason, Applicants' independent claim 1 is patentable over *Roesner*. Consequently, Applicants respectfully request that this rejection be withdrawn.

Furthermore, *Roesner* provides no suggestion that would have motivated a person having ordinary skill in the art to modify the disclosed arrangement to render the claimed invention obvious to a person having ordinary skill in the art of semiconductor devices. *Roesner* discloses a transistor structure in which the carbon nanotube (108) is circumferentially gated because the

nanotube (108) is located in a hole defined within the peripheral edges of the gate electrode (104). In *Roesner*, a gate voltage supplied to the gate electrode (104) directs a bias potential isotropically about the entire circumference of the hole (106) toward the nanotube (108) to form a channel between the source and drain. In Applicants' claimed structure, the gate electrode of conductive material is located only on one side of the passage in which the nanotube is located and the spacer of dielectric material is located on an opposite side of the passage. The bias potential in Applicants' claimed arrangement of the nanotube, spacer and gate electrode lacks this isotropic character. There is no disclosure in *Roesner* that suggests the desirability of the Applicants' claimed arrangement.

Because claims 2-15 depend from independent claim 1, Applicants submit that these claims are also patentable for at least the same reasons discussed above. Furthermore, these claims recite unique combinations of elements not taught, disclosed or suggested by *Roesner*.

Independent claim 42, as amended, is patentable for at least the same or similar reasons as independent claim 1. Because claims 43-45 depend from independent claim 42, Applicants submit that these claims are also patentable for at least the same reasons discussed above. Furthermore, these claims recite unique combinations of elements not disclosed or suggested by *Roesner*.

Dubin Rejections

Claims 1, 5-8, 12-15 and 42-45 also stand rejected under 35 U.S.C. § 102(e) as anticipated by Dubin et al. (U.S. Pub. No. 2005/0167755), hereinafter *Dubin*. Claims 2-4 and 9-11 stand rejected under 35 U.S.C. § 102(e) as anticipated by or, in the alternative, rejected under 35 U.S.C. § 103(a) as obvious over *Dubin*. Claims 1 and 42 are the only independent claims. The Examiner contends that *Dubin* shows or teaches all the elements of the rejected claims. Applicants respectfully disagree for the reasons set forth below.

In contrast to claim 1, as amended, *Dubin* does not disclose or suggest a "gate electrode," "a spacer of a dielectric material flanking said vertical sidewall and spaced horizontally from said vertical sidewall of said gate electrode to define a vertical passage," "a semiconducting nanotube

positioned in said vertical passage," and "a gate dielectric disposed on said sidewall between said semiconducting nanotube and said gate electrode." Instead, *Dubin* discloses a structural arrangement in which nanotubes (250) are positioned inside a ring-shaped passage (203) defined between concentric ring-shaped gate electrodes (202), which a person having ordinary skill in the art would understand to be constituted by a conductive material. *See* paragraph [0049]. *Dubin* discloses that the gate electrodes (202) are coupled with electrical contacts (224) in vias (232, 234) and, hence, are both biased with a voltage during operation of the device to define a channel in the nanotubes (250). *See* paragraph [0053]. Hence, the gate electrodes (202) in *Dubin* effectively constitute a single body of conductive material electrically that consists of concentric rings of conductive material and a ring-shaped trough bounded between the concentric rings of conductive material in which the nanotubes (250) are situated. It follows that the ring-shaped trough in *Dubin* is similar to the hole (106) in *Roesner* that is surrounded by the conductive material of the gate electrode (104), but merely of a different geometrical shape in *Dubin*. The actual sidewalls of the gate electrodes (202) are the radially innermost sidewall of the inner ring electrode (202) of conductive material or the radially outermost sidewall of the outer ring electrode (202) of conductive material. Neither of these sidewalls borders the ring-shaped passage and the spacer (215) identified by the Examiner does not flank either of these sidewalls. Hence, the ring-shaped trough in *Dubin* is not defined between the spacer and the sidewall of the gate electrode, as claimed in Applicants' claim 1.

Applicants' passage is bounded on one side by the sidewall (31) of the gate electrode (28a) and on the other side by the dielectric material of the spacer (32), as set forth in Applicants' amended claim 1. Applicants unambiguously show the sidewall (31) of the gate electrode that flanks the passage (34) in which the nanotube is located as an exterior sidewall of the body of conductive material constituting the gate electrode (28a). *See, e.g.*, Fig. 13B of Applicants' specification. The sidewall (31) of gate electrode (28a) does not border an interior surface because the passage (34) is not defined within the body of conductive material constituting gate electrode (28a).

In order for a reference to anticipate the invention in a claim, the reference must teach each and every element in the precise arrangement set forth in the claim. If the reference fails to teach even one of the claimed elements, the reference does not and cannot anticipate the claimed invention. *Dubin* fails to disclose the arrangement of the sidewall of the gate electrode, the spacer, and the passage, as set forth in Applicants' claim 1, as amended. For at least this reason, Applicants' independent claim 1 is patentable over *Dubin*. Consequently, Applicants respectfully request that this rejection be withdrawn.

Furthermore, *Dubin* provides no suggestion that would have motivated a person having ordinary skill in the art to modify the disclosed arrangement to render the claimed invention obvious to a person having ordinary skill in the art of semiconductor devices. *Dubin* discloses a transistor structure in which carbon nanotubes (250) are inside a ring-shaped passage (203) that is gated by inner and outer ring-shaped electrodes (202) bounding the passage (203). In *Dubin*, a gate voltage supplied to the gate electrodes (202) directs a bias potential from a radially-inward side of the ring-shaped passage (203) and a radially-outward side of the ring-shaped passage (203) to form a channel between the source and drain of the nanotubes (250). In Applicants' claimed structure, the gate electrode of conductive material is located only on one side of the passage and the spacer of dielectric material is located on an opposite side of the passage. The bias potential in Applicants' claimed arrangement of the nanotube, spacer and gate electrode lacks this radially-inward and radially-outward energy transfer. There is no disclosure in *Dubin* that suggests the desirability of Applicants' claimed arrangement.

Because claims 2-15 depend from independent claim 1, Applicants submit that these claims are also patentable for at least the same reasons discussed above. Furthermore, these claims recite unique combinations of elements not taught, disclosed or suggested by *Dubin*.

Independent claim 42, as amended, is patentable for at least the same or similar reasons as independent claim 1. Because claims 43-45 depend from independent claim 42, Applicants submit that these claims are also patentable for at least the same reasons discussed above.

Furthermore, these claims recite unique combinations of elements not disclosed or suggested by *Dubin*.

Conclusion

Applicants have made a bona fide effort to respond to each and every requirement set forth in the Office Action. In view of the foregoing amendments and remarks, this application is submitted to be in complete condition for allowance and, accordingly, a timely notice of allowance to this effect is earnestly solicited. In the event that any issues remain outstanding, the Examiner is invited to contact the undersigned to expedite issuance of this application.

Applicants do not believe fees are dues in connection with filing this communication. If, however, any fees are necessary as a result of this communication, the Commissioner is hereby authorized to charge any under-payment or fees associated with this communication or credit any over-payment to Deposit Account No. 23-3000.

Respectfully submitted,

21 November 2005
Date

William R Allen

William R. Allen, Ph.D.
Reg. No. 48,389
WOOD, HERRON & EVANS, L.L.P.
2700 Carew Tower
441 Vine Street
Cincinnati, Ohio 45202
Telephone: (513) 241-2324
Facsimile: (513) 241-6234